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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* PAUL MARIE AYOUB, STEVEN C. SUMROW,  
HENK DIRKZWAGER and BRENDAN DERMOT MURRAY

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Appeal 2009-0209  
Application 10/772,023  
U.S. Patent Publication 2004-0176655  
Technology Center 1700

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Decided:<sup>1</sup> February 19, 2009

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*Before:* JAMES T. MOORE, *Vice Chief Administrative Patent Judge*,  
FRED E. McKELVEY, *Senior Administrative Patent Judge*,  
and SALLY GARDNER LANE, *Administrative Patent Judge*.

McKELVEY, *Senior Administrative Patent Judge*.

DECISION ON APPEAL

- 1           A. Statement of the case
- 2           Shell Oil Company ("Shell"), the real party in interest, seeks review
- 3           under 35 U.S.C. § 134(a) of a final rejection (mailed 10 October 2006) of
- 4           claims 1-43 as being unpatentable under 35 U.S.C. § 103 over

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<sup>1</sup> The two-month time period for filing an appeal or commencing a civil action, as recited in 37 CFR § 1.304, begins to run from the date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery)

(1) Marinangeli 1, U.S. Patent 6,187,981 B1, (2) Marinangeli 2, U.S. Patent 6,111,158, and, (3) as to some claims, Funk, U.S. Patent 5,523,503.

Marinangeli 1 and 2 and Funk are prior art under 35 U.S.C. § 102(b).

We have jurisdiction under 35 U.S.C. § 134(a).

#### B. Findings of fact

The following findings of fact are supported by a preponderance of the evidence. To the extent that a finding of fact is a conclusion of law, it may be treated as such. Additional findings as necessary may appear in the Discussion portion of the opinion.

#### Claims on appeal

Claims 1-43 are on appeal.

Claim 44-281 also appear in the application on appeal, but have been withdrawn from consideration based on restriction requirements. Final Rejection, page 2.

In presenting the appeal, Shell does not single out claims 2-43 for separate consideration.

Accordingly, we will decide the appeal on the basis of claim 1. 37 C.F.R. § 41.37(c)(1)(vii) (2008).

#### The invention

The invention on appeal relates to method for preparing branched alkyl aromatic hydrocarbons. Specification, page 1:10-11.

The invention can generally be understood with reference to Fig. 1 of the drawings of the application and claim 1 below.

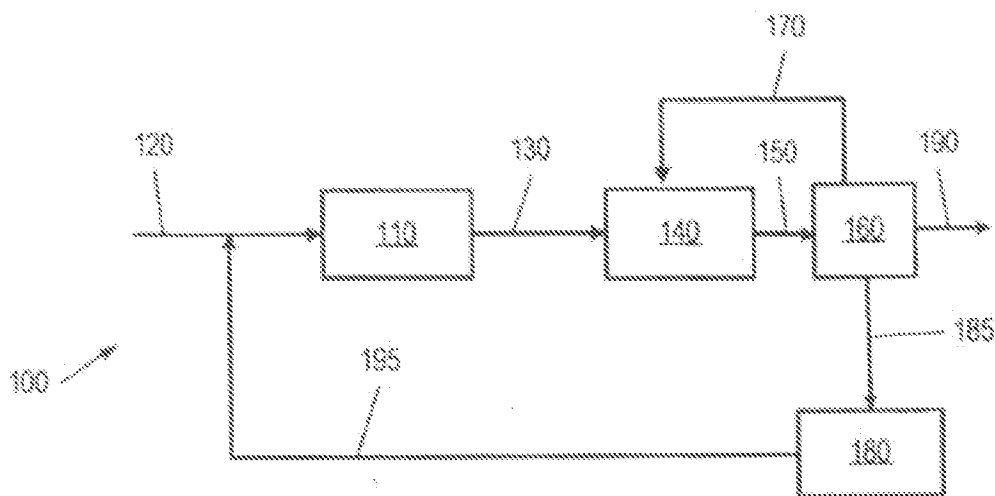


FIG. 1

Figure 1 depicts a schematic diagram of an embodiment of a system for producing branched alkyl aromatic hydrocarbons using an olefin isomerization unit.

With reference to Fig. 1, claim 1 on appeal reads [some indentation, drawing numbers and bracketed matter added]:

Claim 1

A method for the production of alkyl aromatic hydrocarbons, comprising:

- [1] introducing [via 1st conduit 120] a first hydrocarbon stream comprising [a] olefins and [b] paraffins into an isomerization unit 110, wherein the isomerization unit 110 is configured to isomerize at least a portion of linear olefins in the first hydrocarbon stream 120 to branched olefins, and

1                    wherein at least a portion of the unreacted components  
2                    [non-isomerized linear olefins and unreacted paraffins] of the  
3                    first hydrocarbon stream 120 and at least a portion of the  
4                    produced branched olefins form a second hydrocarbon stream  
5                    [in 2d conduit 130];

6            [2] introducing [a] at least a portion of the second hydrocarbon  
7 stream 130 and [b] aromatic hydrocarbons [not shown] into an alkylation  
8 unit 140,

9                    wherein the alkylation unit 140 is configured to alkylate  
10                  [a] at least a portion of the aromatic hydrocarbons with [b] at  
11                  least a portion of the olefins in the second hydrocarbon stream  
12                  130 to produce alkyl aromatic hydrocarbons,

13                  wherein at least a portion of the produced alkyl aromatic  
14                  hydrocarbons comprise a branched alkyl group, and

15                  wherein [a] at least a portion of the unreacted  
16                  components of the second hydrocarbon stream 130, [b] at least  
17                  a portion of the aromatic hydrocarbons and [c] at least a portion  
18                  of the produced alkyl aromatic hydrocarbons form an alkylation  
19                  reaction stream [in 3d conduit] 150;

20            [3] separating alkyl aromatic hydrocarbon from the alkylation  
21 reaction stream [in separator 160] to produce [a] an unreacted hydrocarbons  
22 stream [in 5th conduit] 185 and [b] an alkyl aromatic hydrocarbons stream  
23 [in 6th conduit] 190;

1                   the unreacted hydrocarbons stream 185 comprising [a] at  
2                   least a portion of the unreacted components of the second  
3                   hydrocarbon stream 130 and [b] aromatic hydrocarbons;  
4           [4] separating [in separator 160] [a1] at least a portion of the paraffins  
5 and [b1] at least a portion of the olefins from the unreacted hydrocarbons  
6 stream to produce [a2] an aromatic hydrocarbons stream [in 4th conduit] 170  
7 and [b2] a paraffins and unreacted olefins stream 185; and  
8           [5] introducing at least a portion of the paraffins and unreacted  
9 olefins stream into a dehydrogenation unit 180,  
10                   wherein the dehydrogenation unit 180 is configured to  
11                   dehydrogenate at least a portion of paraffins in the paraffins and  
12                   unreacted olefins stream to produce olefins, and  
13                   wherein at least a portion of the produced olefins exit the  
14                   dehydrogenation unit to form an olefinic hydrocarbon stream  
15                   [in 7th conduit] 195; and  
16           [6] introducing at least a portion of the olefinic hydrocarbon stream  
17 195 into the isomerization unit 110.

18  
19           The overall process of claim 1 is further understood by reference to  
20 certain parts of the specification.

21           A first hydrocarbon stream containing olefins and paraffins is  
22 introduced into isomerization unit 110 via first conduit 120. Specification,  
23 page 15:12-13.

1           A feed stream comprising olefins and paraffins can be obtained  
2   through cracking of paraffin and/or oligomerization of olefins.  
3   Specification, page 12:26-27.

4           In isomerization unit 110, at least a portion of the olefins in the first  
5   hydrocarbon stream are isomerized to branched olefins to produce a second  
6   hydrocarbon stream. Specification, page 15:18-20

7           The conditions for olefin isomerization in isomerization unit 110 may  
8   be controlled such that the number of carbon atoms in the olefins prior to  
9   and subsequent to the isomerization conditions is substantially the same.  
10   U.S. Patent 5,648,584 (Murray, entitled "Process for Isomerizing Linear  
11   Olefins to Isoolefins") and U.S. Patent 5,648,585 (Murray et al., entitled  
12   "Process for Isomerizing Linear Olefins to Isoolefins") are said to describe,  
13   in detail, catalysts and process conditions to skeletally isomerize linear  
14   olefins to branched olefins. Specification, page 16:1-7.

15           Isomerization unit 110 produces a second hydrocarbon stream that  
16   includes olefins and paraffins. At least a portion of the second hydrocarbon  
17   stream contains branched olefins. Specification, page 20:24-25.

18           The second hydrocarbon stream exits isomerization unit 110 via  
19   second conduit 130 and is introduced into alkylation unit 140.  
20   Specification, page 20:26-27.

21           Alkylation of aromatic hydrocarbons by at least a portion of  
22   branched olefins produced in isomerization unit 110 may be conducted  
23   using various types of reactors. Specification, page 20:27-29.

24           For example, the alkylation process may be carried out in a batch wise  
25   fashion by adding the catalyst and aromatic hydrocarbons to a reactor,

1 heating the mixture to a reaction temperature, and then adding the olefinic  
2 and/or aromatic hydrocarbons to the heated mixture. Specification,  
3 page 20:29-31.

4 At least a portion of the olefins in the second hydrocarbon stream 130,  
5 produced by isomerization unit 110, is contacted with aromatic  
6 hydrocarbons (e.g., benzene) using a variety of alkylating conditions.  
7 Specification, page 21:21-23.

8 Alkylation catalysts can be used in alkylation unit 140, including  
9 zeolites in acidic form. Specification, page 24:1.

10 Suitable zeolite alkylation catalysts are described in U.S. Patent  
11 6,111,158 (Marinangeli 2, entitled "Process for Producing Arylalkanes at  
12 Alkylation Conditions Using a Zeolite Having a NES Zeolite Structure  
13 Type") and U.S. Patent 5,041,402 (Schoennagel et al., entitled "Thermally  
14 Stable Noble Metal-Containing Zeolite Catalyst". Specification,  
15 page 24:9-15.

16 In alkylation unit 140, at least a portion of the olefins in the second  
17 hydrocarbon stream 130 and at least a portion of the aromatic hydrocarbons  
18 are reacted under alkylation conditions in the presence of the alkylation  
19 catalyst. Specification, page 26:4-6.

20 Alkylation reaction mixture stream 150 enters separator 160 via third  
21 conduit 150. Specification, page 27:12.

22 In separator 160 at least two streams, an unreacted hydrocarbons  
23 stream 185 and an alkyl aromatic hydrocarbon stream 190 are produced.  
24 Specification, page 27:13-14.



1 Separation of at least a portion of unreacted hydrocarbons from the  
2 produced branched alkyl aromatic hydrocarbons is accomplished by  
3 methods generally known (e.g., distillation, solid/liquid separation,  
4 adsorption, solvent extraction). Specification, page 27:14-16.

5 A portion of the separated aromatic hydrocarbons stream is recycled  
6 to alkylation unit 140 via fourth conduit 170. Specification, page 27:26-28.

7 A portion of the purified alkyl aromatic hydrocarbon product stream is  
8 transferred through sixth conduit 190 to be stored on site [not shown], sold  
9 commercially, transported off-site and/or utilized in other processing units  
10 [not shown]. Specification, page 28:11-14.

11 A portion of the separated paraffins and unreacted olefins are  
12 introduced into dehydrogenation unit 180 via fifth conduit 185.  
13 Specification, page 27:28-29 and page 30:1-2.

14 In the dehydrogenation unit 180, a portion of the unreacted paraffins  
15 in the hydrocarbon stream are dehydrogenated to produce an olefinic  
16 hydrocarbon stream by use of a wide range of catalysts. Specification,  
17 page 28:18-20.

18 Suitable procedures for preparing catalysts and performing the  
19 dehydrogenation step are described in (1) U.S. Patent 5,012,021 (Vora et  
20 al., entitled "Process For the Production of Alkyl Aromatic Hydrocarbons  
21 Using Solid Catalysts"); (2) U.S. Patent 3,274,287 (Moore et al., entitled  
22 "Hydrocarbon Conversion Process and Catalyst"); (3) U.S. Patent  
23 3,315,007 (Abell et al., entitled "Dehydrogenation of Saturated  
24 Hydrocarbons Over Noble-Metal Catalyst"); (4) U.S. Patent 3,315,008  
25 (Abell et al., entitled "Dehydrogenation of Saturated Hydrocarbons Over

1 Noble-Metal Catalyst"); (5) U.S. Patent 3,745,112 (Rausch, entitled  
2 "Platinum-Tin Uniformly Dispersed Hydrocarbon Conversion Catalyst and  
3 Process"); (6) U.S. Pat. No. 4,506,032 (Imai et al., entitled  
4 "Dehydrogenation Catalyst Composition") and (7) U.S. Patent 4,430,517  
5 (Imai et al., entitled "Dehydrogenation Process Using a Catalytic  
6 Composition").

7 The olefinic hydrocarbon stream 195 is combined with first  
8 hydrocarbon stream in first conduit 120 of isomerization unit 110 via  
9 seventh conduit 195 and is then introduced into isomerization unit 110.  
10 Specification, page 30:17-20.

11 Examiner's rejection

12 In rejecting the claims on appeal, the Examiner found that all of the  
13 process steps called for by Shell's claim 1 are described in either  
14 Marinangeli 1 of Marinangeli 2. Examiner's Answer, pages 3-4.

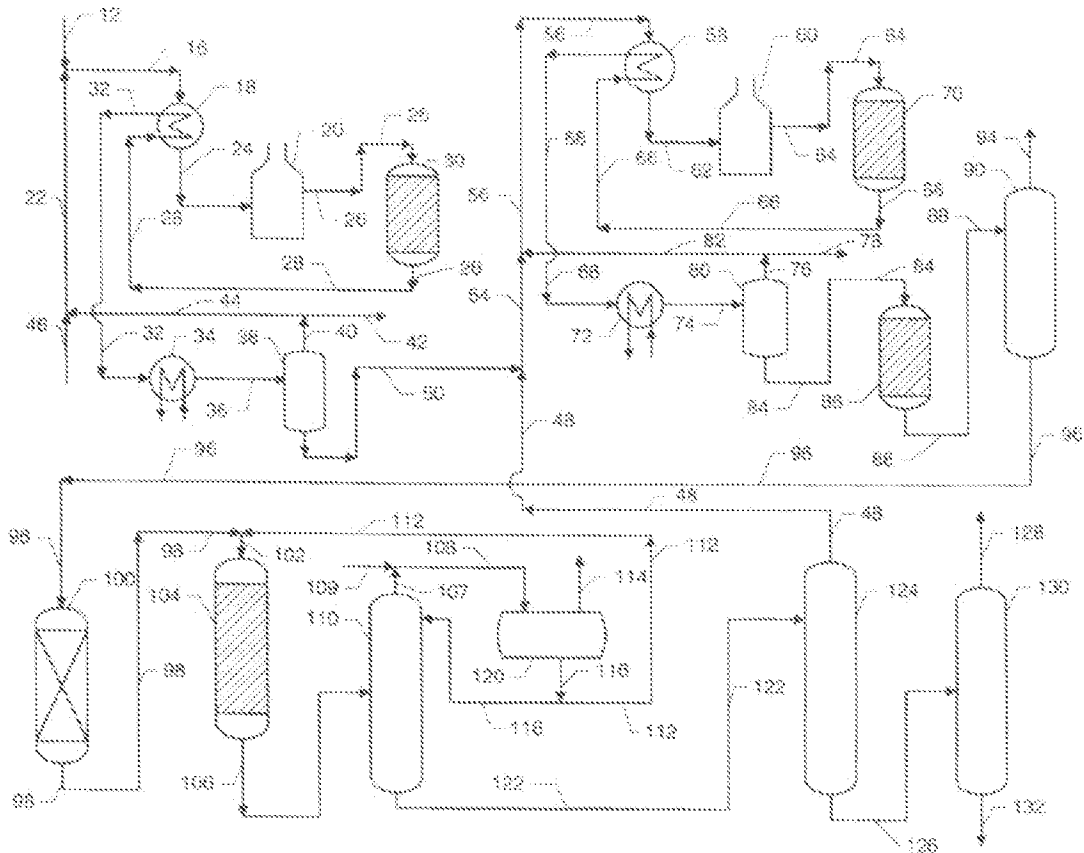
15 In essence, the Examiner held that it would have been obvious to one  
16 having ordinary skill in the art to use the known process steps to make  
17 branched alkyl aromatic hydrocarbons as set out in claim 1. Examiner's  
18 Answer, page 4; Final Rejection, page 4.

19 Prior art

20 The prior art relied upon by the Examiner (Marinangeli 1 and  
21 Marinangeli 2), as well as the prior art cited in the specification, confirm that  
22 all the process steps in claim 1 are being used for the intended purpose and  
23 each step performs precisely in the manner which one having ordinary skill  
24 in the art would have expected.

(1) Marinangeli 1

We start with the Marinangeli 1 drawing below.



With reference to claim 1 of Marinangeli 1 and its drawing, Marinangeli 1 describes a process for producing arylalkanes comprising the steps of:

(a) passing a feed stream 26 containing paraffins to an isomerization zone 30, operating the isomerization zone at isomerization conditions sufficient to isomerize paraffins, and recovering from the isomerization

1 zone an isomerized product stream 28 comprising lightly branched paraffins  
2 [col. 29:46-52];

3 (b) passing at least a portion of the isomerized product stream 28 to  
4 a dehydrogenation zone 70, operating the dehydrogenation zone at  
5 dehydrogenation conditions sufficient to dehydrogenate paraffins [i.e.,  
6 convert branched paraffins to branched olefins], and recovering from the  
7 dehydrogenation zone a dehydrogenated product stream 66 comprising  
8 branched monoolefins and branched paraffins, wherein at least a portion of  
9 the monoolefins in the dehydrogenated product stream 66 have 3 or 4  
10 primary carbon atoms and no quaternary carbon atoms [col. 30:19-25];

11 (c) passing an aryl compound and at least a portion of the  
12 dehydrogenated product stream comprising monoolefins to an alkylation  
13 zone 104, operating the alkylation zone at alkylation conditions sufficient to  
14 alkylate the aryl compound with monoolefins in the presence of an  
15 alkylation catalyst to form arylalkanes comprising molecules having one aryl  
16 portion and one aliphatic alkyl portion [col. 31:18-23];

17 (d) recovering from the alkylation zone 104 an alkylate product  
18 stream 106 comprising arylalkanes 128 [from rerun column 130] and a  
19 recycle stream 48 [from paraffin column 124] comprising paraffins  
20 [col. 31:24-58]; and

21 (e) passing at least a portion of the recycle stream to the  
22 isomerization zone [not shown] or the dehydrogenation zone 70.

23 Dehydrogenation unit 70 of Marinangeli 1 functions in the same  
24 manner and produces the same result as Shell's dehydrogenation unit 180.

1 Both dehydrogenation units convert paraffins to olefins by taking hydrogen  
2 away from the paraffins to produce olefins.

3 Alkylation 104 of Marinangeli 1 functions in the same manner and  
4 produces the same result as Shell's alkylation unit 160. Both produce a  
5 branched chain alkylated aromatic compound.

6 Isomerization unit 30 of Marinangeli 1 is not involved in Shell's  
7 process. The product of isomerization unit 30 would be the feed into Shell's  
8 first conduit 120 before it mixes with product from 7th conduit 195.

9 While both Marinangeli 1 and Shell seek to obtain branched alkylated  
10 aromatic compounds, the difference between Shell's claim 1 and  
11 Marinangeli 1, as noted by the Examiner, is process steps take place in a  
12 different order.

13 (2) Marinangeli 2

14 Marinangeli 2 does not have a drawing.

15 In describing the prior art, Marinangeli 2 notes that a standard process  
16 for producing BAB [branched alkylbenzenes] involves oligomerizing light  
17 olefins to branched olefins and then alkylating benzene with the branched  
18 olefins in the presence of a catalyst. Col. 1:42-45. While Shell calls  
19 "oligomerizing" "isomerization," what Shell does in isomerization unit 110  
20 and alkylation unit 130 is what Marinangeli 2 refers to as a standard process.

21 With reference to Marinangeli 2 claim 1, there is described a process  
22 for producing arylalkanes. Col. 18:41.

23 The process comprises contacting an olefin feed comprising  
24 monoolefin molecules having 3 or 4 primary carbon atoms with no  
25 quaternary carbon atoms [carbon atoms bonded to 4 other carbon atoms]

1 with an aryl compound [benzene] at alkylation conditions in the presence of  
2 a zeolite having an NES zeolite structure type, wherein the arylalkanes  
3 comprise molecules comprising one aliphatic alkyl portion and one aryl  
4 portion; the aliphatic alkyl portion has from about 8 to about 28 carbon  
5 atoms, has 2, 3, or 4 primary carbon atoms, and has no quaternary carbon  
6 atoms except for any quaternary carbon atom bonded by a carbon-carbon  
7 bond with a carbon atom of the aryl portion.

8 The alkylation described by Marinangeli 2 and the alkylation which  
9 occurs in Shell's alkylation unit 130 is the same.

10 As noted by the Examiner (Answer, page 4), Marinangeli 2 describes  
11 an isomerization step which converts linear olefins to branched olefins  
12 which can be used as an olefinic feedstock. Col. 9:64-66. The feedstock is  
13 the "olefin feed" mentioned above.

14 As further noted by the Examiner (Answer, page 4), Marinangeli 2  
15 describes the reaction of the lightly branched monoolefins with an aryl  
16 compound, which can be benzene. Col. 10:19-20.

17 Rebuttal evidence

18 Shell does not rely on rebuttal evidence.

19 C. Discussion

20 Examiner's § 103 rejection

21 As noted earlier in the findings, Shell is using known process steps  
22 [(1) isomerization of olefins to branched olefins, (2) alkylation of branched  
23 olefins to aromatic compounds and (3) dehydrogenation of paraffins to  
24 produce olefins] for their known purpose all the while achieving an entirely  
25 predictable result.

1 Shell's principal attack on the Examiner's rejection is that the  
2 Examiner supposedly has failed to show adequate motivation for doing what  
3 Shell claims in claim 1.

4 What Shell is looking for is an express statement in the prior art that  
5 explicitly suggests the process step order set out in claim 1. We now know  
6 from *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1741 (2007), that one  
7 need not seek out precise teachings directed to the specific subject matter  
8 claimed. Rather, one can take account of the inferences and creative steps  
9 that a person of ordinary skill in the art would employ. Further, as *KSR*  
10 notes, a person of ordinary skill is not an automaton. 127 S. Ct. at 1742.

11 Shell acknowledges that the Examiner held that it would have been  
12 obvious to place the dehydrogenation step after the alkylation step instead of  
13 between the isomerization step and the alkylation step. Appeal Brief,  
14 page 10. But, says Shell, the Examiner failed to cite a reference to support  
15 the Examiner's position. *Id.*

16 Part of the problem in this case is that Shell uses the term  
17 "isomerization" to mean one thing and Marinangeli 1 uses the term to mean  
18 something else. Shell means converting linear olefins to branched olefins.  
19 Marinangeli 1 means converting paraffins to olefins. However, any attempt  
20 to "hide" behind any wordsmith distinction is immediately "uncovered" by a  
21 penetrating analysis of the prior art as a whole.

22 In "isomerization" unit 30 Marinangeli 1 makes branched paraffins.  
23 The branched paraffins are converted to branched olefins in dehydrogenation  
24 unit 70. At this point, we now have branched olefins which can be reacted  
25 with aromatic compounds in alkylation unit 160. In essence, these

1 Marinangeli 1 steps correspond to what is going on in Shell's  
2 dehydrogenation unit 180 where paraffins are converted to olefins with  
3 subsequent branching in isomerization unit 110. What Marinangeli 2 reveals  
4 as olefins "oligomerized" to branched olefins is exactly what happens in  
5 Shell's "isomerization" unit 110. What Marinangeli 2 means by  
6 "oligomerization" is the same thing that Shell means by "isomerization."

7 Like Shell, Marinangeli 1 produces a mixture of olefins, paraffins and  
8 alkylated aromatic compound from the bottom stream 106 of alkylation unit  
9 104. Also like Shell, Marinangeli 1 sends the paraffins to its dehydrogenator  
10 unit 70 to make olefins, which along with olefins already entering the  
11 dehydrogenator are ultimately used in the alkylation unit 104.

12 One having ordinary skill knows that one way to alkylate an aromatic  
13 compound is to react (1) a branched olefin with (2) an aromatic compound,  
14 e.g., benzene. Marinangeli 1, alkylation unit 104.

15 One having ordinary skill further knows that to obtain branched  
16 olefins, one can (1) take paraffins and make branched paraffins then  
17 dehydrogenate the branched paraffins to make branched olefins (that is  
18 Marinangeli 1 does, but not Shell) or (2) oligomerize linear olefins to make  
19 branched olefins (that is what both Marinangeli 2 and Shell do). See, e.g.,  
20 Marinangeli 2, col. 2:42-44 and col. 9:64-66.

21 One having ordinary skill still further knows that it often makes sense,  
22 for cost efficiency and environmental reasons, to recycle. That is what both  
23 Marinangeli 1 and Shell do). See, e.g., Marinangeli 1, recycle conduit 48.



1 Shell is using known steps for their intended purpose to achieve  
2 nothing more than an expected result. Under the facts of this case, Shell has  
3 failed to overcome the § 103 hurdle.

4 We have not overlooked Shell's statement that the invention is said to  
5 provide "a method for producing alkylated aromatics that produce  
6 surfactants having excellent biodegradability and detergency at reduced  
7 production costs. Appeal Brief, page 7. First, Shell is not claiming  
8 surfactants. Second, Shell has not shown (or argued) that the products  
9 produced by the process of claim 1 lead to the allegedly improved  
10 surfactants. We therefore are unable to find based on the arguments made  
11 that there is any unexpected result associated with the process of claim 1.

12 The Examiner and Shell cite numerous cases. We are content to cite  
13 and rely on *KSR* and therefore do not find it necessary to address the cases  
14 cited by the Examiner and Shell.

15 We have considered Shell's remaining arguments and find none that  
16 warrant reversal of the Examiner's rejection(s). *Cf. Hartman v. Nicholson*,  
17 483 F.3d 1311, 1315 (Fed. Cir. 2007).

18 D. Decision

19 Shell has not sustained its burden on appeal of showing that the  
20 Examiner erred in rejecting the claims on appeal as being unpatentable under  
21 35 U.S.C. § 103 over the prior art.

22 On the record before us, Shell is not entitled to a patent containing  
23 claims 1-43.

Appeal 2009-0209  
Application 10/772,023

1           Upon consideration of the appeal, and for the reasons given herein,  
2 it is

3                   ORDERED that the decision of the Examiner rejecting  
4 claims 1-43 over the prior art is *affirmed*.

5                   FURTHER ORDERED that no time period for taking any  
6 subsequent action in connection with this appeal may be extended under  
7 37 C.F.R. § 1.136(a)(1)(iv) (2008).

AFFIRMED

rvb

cc (via First Class mail)

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